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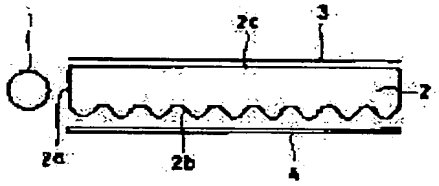
(54) SURFACE LIGHT SOURCE DEVICE

(57)Abstract:
PURPOSE: To obtain the surface light source device which uses a photoconductor having a uniform luminance distribution by forming the back surface of the photoconductor, i.e., the opposite surface to a projection surface into wavy uneven surface so that the uneven surface is continuously formed with curved surfaces or curved surfaces and planes in any directions continuously, and roughly finishing the surface.
CONSTITUTION: The surface light source device includes the photoconductor 2 having the reverse surface 2b in the wavy shape as shown in the figure. Further, the waveform is successive not only in section perpendicular to an incidence end surface 2a as shown in the figure, but also in different section of a plane perpendicular to the surface 2c, e.g. section parallel to the incidence end surface 2a or section slanting to the incidence end surface 2a. The back surface 2b of the photoconductor is therefore a continuous surface formed of curved surfaces or planes and curved surfaces in combination and includes none of a part like the apex angle of a cone, a linear part like a ridge, etc. Then, the curved surfaces of this waveform surface are roughly finished by forming what is called crimps.



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CLAIMS

[Claim(s)]
[Claim 1] In surface light source equipment equipped with the straight-line-like light source, the transparent material which the incidence end face was made to approach said light source, and has been arranged, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which counters [said outgoing radiation side of said transparent material, and] Surface light source equipment which is what made the field of the side which counters [said outgoing radiation side of said transparent material, and] many wave-like concavo-convex sides, and is characterized by forming this wave-like irregularity continuously of the curved surface or the curved surface, and the flat surface also in which direction, and making this field into a split face.
[Claim 2] Surface light source equipment [claim 3] of claim 1 characterized by the height of a wave becoming size as the height of the wave by the side of an incidence end face separates [the configuration of the wave of said wave-like concavo-convex field] from an incidence end face by smallness Surface light source equipment [claim 4] of claim 1 characterized by wavelength becoming smallness as wavelength separates [the configuration of the wave of said wave-like concavo-convex side / an incidence end-face side] from an incidence end face in size Surface light source equipment [claim 5] of claim 1 with which the configuration of the wave of said wave-like concavo-convex field is characterized by becoming size or smallness as the angle of inclination between the bottom of the wave by the side of an incidence end face and top-most vertices separates from an incidence end face, and becoming about 45 degrees - 60 degrees in the most distant location Surface light source equipment [claim 6] of claim 1 with which granularity of the split face formed in said wave-like concavo-convex field is characterized by making it become size as the incidence end-face side separated from the incidence end face by smallness The height of a wave of said wave, wavelength, the inclination between the bottom of a wave, and top-most vertices, surface light source equipment of claim 1 characterized by having chosen two or more requirements and changing [from] them suitably among the granularity of the front face of the wave of a wave.
[Claim 7] The straight-line-like light source and the transparent material which the incidence end face was made to approach said light source, and has been arranged, In surface light source equipment equipped with the light reflex member arranged to the said incidence end-face [of said transparent material], and field side which counters, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which

counters [said outgoing radiation side of said transparent material, and] It is what made the field of the side which counters [said outgoing radiation side of said transparent material, and] the wave-like concavo-convex side. It is that to which this wave-like irregularity was continuously formed of the curved surface or the curved surface, and the flat surface also in which direction, broke and got down, and made this field the split face. Surface light source equipment characterized by making it become smallness again as the height of the wave by the side of an incidence end face separated [the configuration of the wave of said wave-like field] from the incidence end face by smallness, the height of a wave became size and said light reflex member was approached.

[Claim 8] The straight-line-like light source and the transparent material which the incidence end face was made to approach said light source, and has been arranged, In surface light source equipment equipped with the light reflex member arranged to the said incidence end-face [of said transparent material], and field side which counters, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which counters [said outgoing radiation side of said transparent material, and] It is what made the light source side the wave-like concavo-convex side in the field of the side which counters [said outgoing radiation side of said transparent material, and]. It is what this wave-like irregularity is continuously formed of the curved surface or the curved surface, and the flat surface also in which direction, and made this field the split face. Surface light source equipment characterized by making it become size again as the wavelength by the side of an incidence end face separated [the configuration of the wave of said wave-like field] from the incidence end face in size, wavelength became smallness and said light reflex member was approached.

[Claim 9] The straight-line-like light source and the transparent material which the incidence end face was made to approach said light source, and has been arranged, In surface light source equipment equipped with the light reflex member arranged to the said incidence end-face [of said transparent material], and field side which counters, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which counters [said outgoing radiation side of said transparent material, and] It is what made the field of the side which counters [said outgoing radiation side of said transparent material, and] the wave-like field. The configuration of the wave of said wave-like concavo-convex side Having made it separate from 45 degrees - 60 degrees by becoming size or smallness again as said reflective member is approached after approaching 45 degrees - 60 degrees by becoming size or smallness and becoming 45 degrees - 60 degrees as the angle of inclination between the bottom of the wave by the side of an incidence end face and top-most vertices separates from an incidence end face Surface light source equipment by which it is characterized.

[Claim 10] The straight-line-like light source and the transparent material which the incidence end face was made to approach said light source, and has been arranged, In surface light source equipment equipped with the light reflex member arranged to the said incidence end-face [of said transparent material], and field side which counters, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which counters [said outgoing radiation side of said transparent material, and] Surface light source equipment with which granularity of the split face which is what made the field of the side which counters [said outgoing radiation side of said transparent material and] the wave-like concavo-convex side, and carried out pilation to said wave-like concavo-convex field is characterized by having become size as the incidence end-face side separated from the incidence end face by smallness, and making it become smallness again as said reflective member was approached.

[Claim 11] In surface light source equipment equipped with the straight-line-like light source, the transparent material which the incidence end face was made to approach said light source, and has been arranged, the diffusion plate arranged to the outgoing radiation side side of said transparent material, and the reflector established in the side which counters [said outgoing radiation side of said transparent material, and] Surface light source equipment which is what made the field of the

side which counters [said outgoing radiation side of said transparent material, and] the wave-like concavo-convex side, and is characterized by having chosen two or more requirements and changing [from] them suitably among the granularity of the front face of the height of a wave of said wave-like concavo-convex side, wavelength, the inclination between the bottom of a wave, and top-most vertices, and the wave of a wave.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the surface light source equipment which used the transparent material.
[0002]
[Description of the Prior Art] The surface light source equipment using the conventional transparent material is a configuration as shown in drawing 11 . That is, that incidence end-face 22a is made to approach the light source 21, a transparent material 22 is arranged, and a reflector 24 is established in the side which counters the diffusion plate 23 with said outgoing radiation side of a transparent material 22 again at the outgoing radiation side side of this transparent material 22. According to such equipment, while carrying out incidence and transmitting that interior in a transparent material 22 from incidence end-face 22a, outgoing radiation of the light from the light source 21 is carried out from the outgoing radiation side of a transparent material 22, and this light that carried out outgoing radiation turns into the diffused light through the diffusion plate 23. This will constitute the surface light source.
[0003] As for such surface light source equipment, it is common to form the minute diffusion section of a fixed pattern configuration with means, such as printing by the coating of diffusibility, in said outgoing radiation side of a transparent material 22, and the field of the side which counters so that the light which carried out incidence to the transparent material 22 may carry out outgoing radiation efficiently and may turn into the diffused light of homogeneity luminance distribution on a diffusion plate surface again.
[0004] Since such surface light source equipment is used for the back light of a liquid crystal display etc., the bright surface light source is required. However, the above conventional surface light source equipments of a configuration cannot obtain sufficient brightness.
[0005] Therefore, in this kind of surface light source equipment, in order to increase brightness, various devices are made.
[0006] For example, the surface light source equipment of a publication is in JP,3-189679,A and JP,3-31782,U. By forming many pyramid-like heights or crevices in the field of the side which counters [said outgoing radiation side of a transparent material, and], as this surface light source

equipment changes buildup of brightness and changed the area of the heights of a scale and the shape of this pyramid, or a crevice by the location, it has achieved equalization of brightness.
[0007] However, by such approach, since the area of the field of a pyramid was comparatively large, brightness could be increased, but even if it changed area, it was difficult [it] to make luminance distribution into homogeneity enough. Moreover, since heights or a crevice is a pyramid-like, there is a fault, like especially the parts (part which became a sharp angle) of an angle shine.
[0008] In order to cancel the above faults, there is surface light source equipment of Heisei 4 utility-model registration **** No. 24601 for which the applicant of this application applied previously, and Heisei 4 utility-model registration **** No. 24608. It is a configuration shown in drawing 12 thru/or drawing 15 and drawing 16 thru/or drawing 19 , respectively.
[0009] The surface light source equipment first shown in drawing 12 thru/or drawing 15 has the heights of the shape of what prepared spherical-surface-like a crevice 25 and the spherical-surface-like heights 26 in field 22a of the field by the side of the outgoing radiation of a transparent material 22, and an opposite hand, cylinder-like crevice 25', or a cylinder, and can make brightness homogeneity by being able to make brightness increase and making these crevices or heights into a split face by this, again.
[0010] Moreover, while making brightness increase by this, form a split face in these crevices or heights, it is made to change by the granularity of this split face, and more uniform luminance distribution is made for the surface light source equipment shown in drawing 16 to be what prepared a crevice or heights in underside 22a of a transparent material 22 similarly, and to be acquired covering the whole outgoing radiation side. Moreover, as shown in drawing 17 thru/or drawing 19 , the pitch of a crevice and heights is changed, or the depth of a crevice or the height of heights is changed, and more uniform luminance distribution is acquired covering the whole outgoing radiation side.
[0011]
[Problem(s) to be Solved by the Invention] Such a corniform part becomes bright compared with other parts, and a cross section contains [each of crevices and heights] a corniform part, and, as for the transparent material shown in such drawing 12 thru/or drawing 19 , it is [shines selectively and] visible. Moreover, since the field which has the heights or the crevice of a transparent material is the configuration by which many heights or crevices were formed in the flat surface, when a transparent material is made thin, even if this heights or crevice lets a diffusion plate pass from a diffusion plate side to eye others [vanity and] clearly, this is not visible and desirable [a field].
[0012]
[Means for Solving the Problem] The surface light source equipment of this invention is what was constituted from the light source, a transparent material which that incidence end face was made to approach this light source, and has been arranged, a diffusion plate arranged to the front-face side (outgoing radiation side side) of a transparent material, and a reflector arranged to the rear-face side (a diffusion plate side and opposite hand) of a transparent material. It is what made the rear face (an outgoing radiation side is a field of an opposite hand) of a transparent material many wave-like concavo-convex sides. It is characterized by considering as the configuration in which the part which this wave-like irregularity is continuously formed of the curved surface or the curved surface, and the flat surface also in which direction, and makes a point or a line does not exist, and further this wave-like rear face as a split face of forming the so-called crimp Equalization of brightness is achieved in accordance with the wave.
[0013] Thus, since the surface light source equipment of this invention makes the wave which the rear face of a transparent material followed, while it can acquire the bright surface light source according to an echo and refraction operation in this wave-like field of light Since change of the direction (inclination of a tangential plane) of each part on this field is continuing, it can make to the good luminance distribution which there is no rapid brightness change also selectively in the top where the luminance distribution of the diffused light is uniform at the whole diffusion plate surface,

and does not shine with it locally. Moreover, since a rear face is a continuation side further, even if a transparent material is transparent and it is not a flat surface, a wave is not in sight from a front-face side.
[0014] Furthermore, when making a wave-like field on the back into a split face, since a rear face is a continuation side, it is easy on processing to make it a desired split face as the whole field.
[0015]
[Example] Next, the example of the surface light source equipment of this invention is explained based on a drawing.
[0016] Drawing 1 is the sectional view of the surface light source equipment of this invention, and, for 1, as for a transparent material and 3, the light source and 2 are [a diffusion plate and 4] reflectors. The surface light source equipment of this example is making a wave which rear-face 2b of a transparent material 2 illustrates. And although this wave-like field shows a cross section vertical to an incidence end face with a drawing in the longitudinal section It is the wave which all followed also in the cross section where a cross-section configuration vertical to surface 2c is parallel to cross-section, for example, incidence end face, 2a from which the vertical plane differs, or incidence end-face 2a and the leaning cross section. Therefore, rear-face 2b of a transparent material is the field which continued in the field which combined the curved surface or the flat surface, and the curved surface in all parts, for example, is a configuration in which neither a part like the vertical angle of a drill configuration nor a part like a ridgeline exists. Furthermore, this wave-like curved surface is a split face.
[0017] In this example, after carrying out incidence from incidence end-face 2a of a transparent material 2, total reflection of the light from the light source 1 is carried out with surface 2c and rear-face 2b, respectively (the light which injected that part from the front face and came out from the rear face again is reflected in a reflector), and with incidence end-face 2a, it is transmitted to an echo side and goes. A part of light carries out outgoing radiation, turns into the diffused light through the diffusion plate 3, and serves as the surface light source from surface 2c here.
[0018] In this example, the light which the light by which total reflection is carried out here since a rear face is a wave side is reflected in the direction which changed with reflective parts, and it is reflected through a rear face in a reflector 4, and carries out incidence again progresses in the direction which was refracted in respect of the wave, respectively and changed with locations. It is equalized by operation of the wave side of this rear-face 2b, and, moreover, the light injected from surface 2c of a transparent material turns into a bright light according to it. Furthermore, by having made the wave-like field into the split face, a diffusion is added and it becomes uniform brightness.
[0019] Since a rear face is a wave and is moreover continuing in all directions here, brightness does not become size selectively [since change is also continuous] by the location of the reflective direction of the light by this field, or the direction which is refracted and goes to a front face, and the part with which it shines on a diffusion plate does not arise. Moreover, also when changing granularity by making all parts into a uniform split face since all parts on the back are continuing when making a rear face into a split face, or the location, it can make comparatively easily.
[0020] Although the wave is indicated in the same configuration by drawing 1 , the directions where light is reflected or refracted in each part with a wave-like configuration and magnitude differ. Therefore, in the lighting system of this invention, in order to obtain a bright thing by more uniform luminance distribution, the configuration and magnitude of a wave are actually changed by the location. Moreover, distribution of a wave amplitude or a configuration is made into a different thing also by the application of surface light source equipment.
[0021] Drawing 2 is drawing showing an example of the cross-section configuration of a wave-like field. In this drawing, the brightness in the outgoing radiation side of the upper part of that wave becomes size from an experimental result, so that height h of a wave is size. The brightness in the outgoing radiation side of the wave-like upper part becomes size, so that f equivalent to the wavelength of **** is smallness. moreover, wave-profile -- as a **, most brightly, the time of

making the angle of inclination of the part of g into 45 degrees - 60 degrees becomes dark as stride becomes smallness from it.
[0022] Generally, the outgoing radiation light of the side (side near an incidence end face) near the light source of a transparent material is size comparatively, and the surface light source equipment using a transparent material becomes smallness gradually as it separates from this. Therefore, it is desirable to make it size gradually as are shown in drawing 3 , and height h of the side near incidence end-face 2a is made into smallness and it separates from this as a wave of the rear face of a transparent material. It becomes possible to make the brightness on the diffusion plate 3 into homogeneity by this.
[0023] Drawing 4 is other examples, it is made the configuration which becomes smallness and the brightness in the front face is made for luminance distribution to become homogeneity as a whole in homogeneity as the side near incidence end-face 2a is size and the wavelength f separates the wave of the rear face of a transparent material 2 from this. In addition, height h is almost fixed in this case.
[0024] Drawing 5 is what has arranged the light source 1 on drawing right-and-left both sides, and makes the whole brightness size. In order to carry out incidence of the light from both sides, he makes height h of the wave of the direction near incidence edge 2a on either side and 2a' into smallness, and is trying for h to become size gradually towards a core in the case of this example. It becomes possible to make brightness in an outgoing radiation side into homogeneity by this.
[0025] Drawing 6 is the example of further others, changes a wave-like configuration continuously and acquires the surface light source of uniform brightness. That is, it is the thing from which it was made for the inclination (the angle theta of drawing 10) of the part of g in drawing 2 to differ one by one, and an incidence end-face side becomes size gradually as an angle of inclination separates by smallness after this, and it is made into within the limits whose angle of inclination is 45 degrees - 60 degrees in near the end face of an incidence end face and an opposite hand.
[0026] Moreover, the inclination of the part of g in drawing 2 becomes smallness gradually at it as an incidence end-face side separates in size conversely after this, and you may make it an angle of inclination serve as drawing 6 in near the end face of an incidence end face and an opposite hand in the range which is 45 degrees - 60 degrees.
[0027] Drawing 7 arranges the light reflex members 5, such as a reflective tape, to 2d side of end faces of incidence end-face 2a of a transparent material 2, and an opposite hand. When 2d of this field is a transparent field, in order that light may come out from this field, there are some which have arranged the light reflex members 5, such as a reflective tape, returned to hard flow, and turned brightness on this field side at size. Thus, when the light reflex members 5, such as a reflective tape, are arranged to the 2d side and the plate-like transparent material a front face and whose rear face are moreover flat surfaces is considered, the brightness by the side of an outgoing radiation side serves as an inclination which increases again as it decreases gradually most brightly in an incidence end face and approaches an incidence end face and 2d of fields of an opposite hand. Therefore, it is desirable to make it smallness again as 2d of fields is approached after the height h makes size gradually the wave of rear-face 2b of a transparent material 2 and performs it by smallness most by the incidence end-face 2a side like drawing 7 .
[0028] A transparent material 12 and the shape of a basic form of 12' itself are what thickness is thin gradually and was carried out in size in an incidence end face, and drawing 8 and drawing 9 make rear-face 12b of these transparent materials, and 12b' the above-mentioned wave.
[0029] Each example shown in drawing 3 thru/or drawing 9 described above is made for the purpose of the common surface light source equipment which used the transparent material canceling the point which becomes smallness as the direction with the amount of the light which carries out outgoing radiation near an incidence end face separates from a transparent material from this in size. Therefore, each change of the angle of inclination of the part of g which is height [of a wave] h, and wavelength f and the configuration of a wave etc. arises in the direction vertical to an

incidence end face. Therefore, the wave by the field multiplexing form where it saw with the whole rear face of a transparent material is the same configuration mostly altogether in the direction vertical to an incidence end face. And in the direction where irregularity with such a wave is parallel to all directions, i.e., incidence end faces, or the direction to which it inclined to the incidence end face, although the aforementioned vertical direction is not necessarily a match, it is the configuration which they connected continuously according to the curved surface or the flat surface, and the curved surface in all, and there is no part used as punctiform or a line.
[0030] Although the thing of the so-called 1 LGT type which has arranged the light source, or 2 LGT type was stated only to one end face of a transparent material, even if it applies the above explanation to the so-called surface light source equipment of 4 LGT type and the surface light source equipment of 3 LGT type which has arranged the light source to three sides of a transparent material which have arranged the light source to all of four sides of a transparent material, it is easy to be natural [the explanation]. The part which the light from the light source cannot reach easily in these cases is made into a wave with the small value of **** f with the big value of the aforementioned h, and the part which light cannot reach easily should just also enlarge granularity of a split face. Furthermore, the inclination of the aforementioned g may be changed. Moreover, among the value of aforementioned h and f, granularity, and the inclination of the aforementioned g, suitably, some terms may be chosen and combined and may be changed [from].
[0031] In addition, what is necessary is just to use the following approach, in order to form the transparent material which made the split face the inner surface of a crevice, and the outside surface of heights. That is, the metal mold which has a wave first is made, and metal mold is made to this by the approach by sandblasting, or etching or an electron discharge method, and it can form in it with shaping means, such as injection molding, using this metal mold. In this case, according to the approach of an electron discharge method, an activity is easy and it is desirable in a desired split face being acquired by accuracy etc.
[0032]
[Effect of the Invention] This invention can be made into the wave in which the part which the curved surface, or a curved surface and a flat surface are continuing the reflector of a transparent material also in which direction, and makes a point or a line does not exist, said reflector can be further made into a split face, and the surface light source equipment in which very uniform luminance distribution is shown can be offered by changing suitably said wave-like height, the inclination of a wavelength wave, and field roughness.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the example of the surface light source equipment of this

invention
[Drawing 2] Drawing showing a wave-like example formed in the transparent material of this invention
[Drawing 3] Drawing showing the example to which height wave-like by the transparent material of the example of this invention was changed by the location
[Drawing 4] Drawing showing the example to which the die length was changed by the location by the transparent material of the example of this invention
[Drawing 5] Drawing showing the example which has arranged the light source to the ends of a transparent material by this invention, respectively
[Drawing 6] Drawing showing the example to which angle-of-inclination theta of a wave was changed by the location by the transparent material of the example of this invention
[Drawing 7] Drawing showing the example which made the reflector the incidence edge and the reflective side edge side by the transparent material of the example of this invention
[Drawing 8] Drawing showing the example which made the rear face incline by the transparent material of the example of this invention
[Drawing 9] Drawing showing the example which made the rear face incline so that central thickness may become smallness by the transparent material of the example of this invention
[Drawing 10] The enlarged drawing having shown inclination theta of the wave formed in the transparent material of the example of this invention
[Drawing 11] The sectional view of conventional surface light source equipment
[Drawing 12] Drawing showing the conventional transparent material in which the hemispherical crevice was formed
[Drawing 13] Drawing showing the conventional transparent material in which the cylindrical crevice was formed
[Drawing 14] Drawing showing the conventional transparent material which formed the curved surface in the crevice of drawing 13 further
[Drawing 15] Drawing showing the conventional transparent material in which hemispherical heights were formed
[Drawing 16] Drawing showing the conventional transparent material which formed the crevice and made the inner surface the split face
[Drawing 17] Drawing showing the conventional transparent material which formed the crevice which changes with locations and made the inner surface the split face
[Drawing 18] Drawing showing the conventional transparent material which transformed the crevice of drawing 17
[Drawing 19] Drawing showing the conventional transparent material which formed the heights which change with locations and made the front face the split face
[Description of Notations]
1 Light Source
2 Transparent Material
2b A wave-like concavo-convex side
3 Diffusion Plate
4 Reflector

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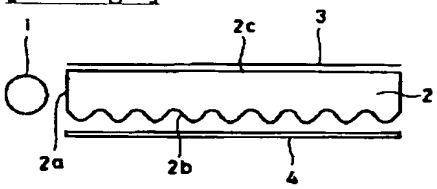
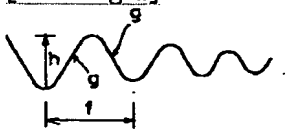
DRAWINGS

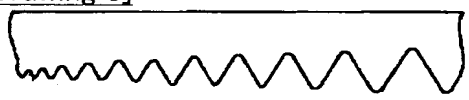
[Drawing 1]



[Drawing 2]



[Drawing 3]



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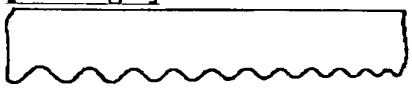

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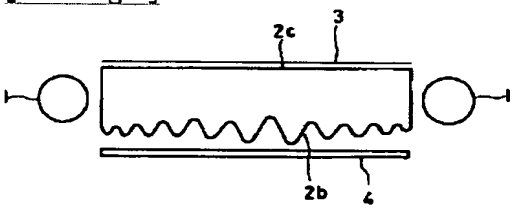
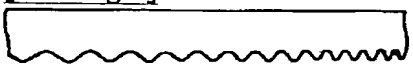
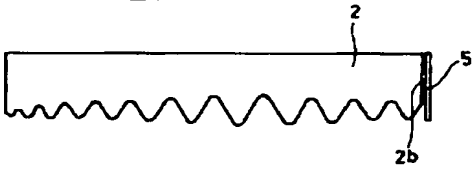


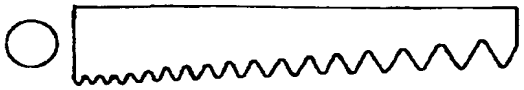
[Drawing 6]



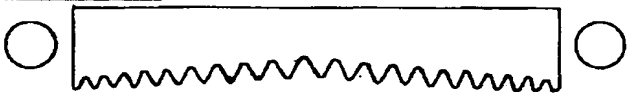
[Drawing 7]



[Drawing 8]



[Drawing 9]



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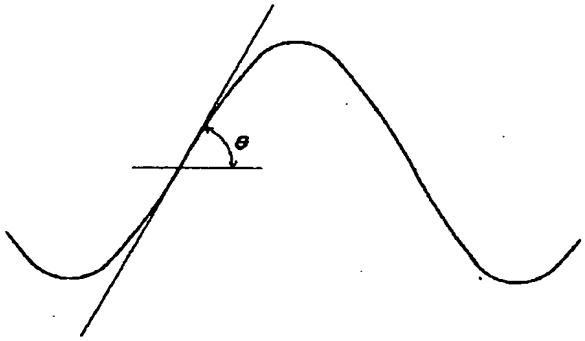

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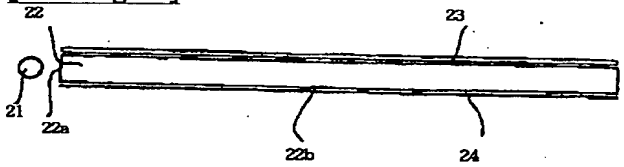

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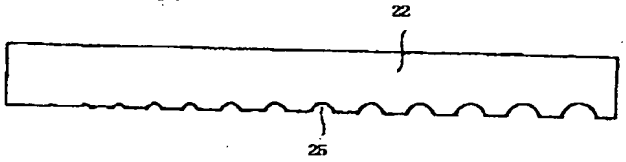

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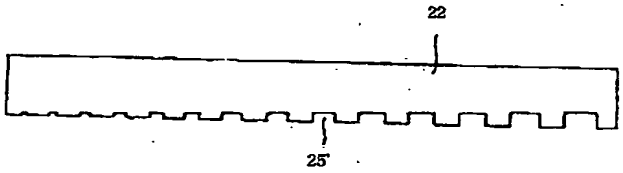

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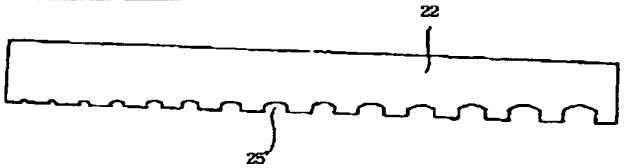

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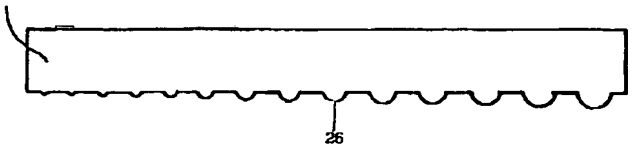

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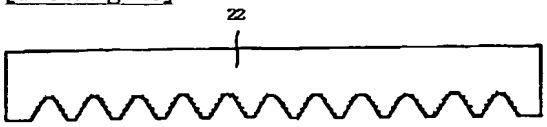

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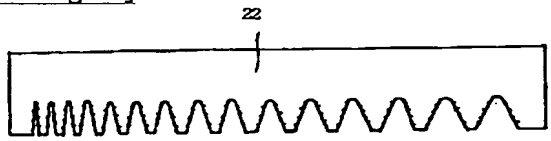

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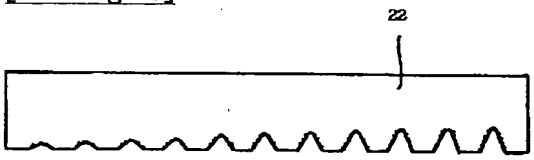

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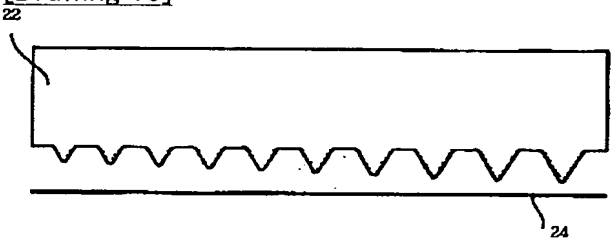

[Translation done.]

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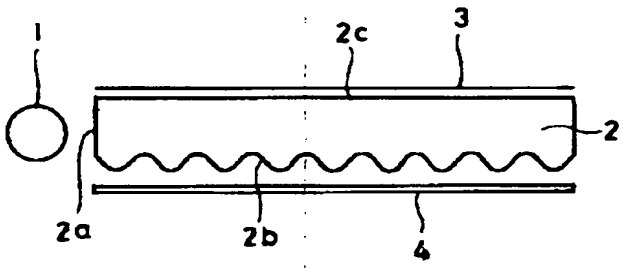
(54)【発明の名称】　面光源装置

(57)【要約】

【目的】　本発明は、明るく均一な輝度分布を有する導光体を用いた面光源装置を提供することを目的としている。

【構成】　本発明の面光源装置は、導光体を用いるもので、この導光体の出射面とは反対側の面に多数の波形の凹凸面を形成し、この波形の凹凸面がすべての方向にて曲面にて連続した形状としたことを特徴としている。



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【特許請求の範囲】

【請求項１】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面を波形の多数の凹凸面としたもので、この波形の凹凸がいずれの方向においても曲面又は曲面と平面とによって連続して形成されておりこの面を粗面としたことを特徴とする面光源装置。

【請求項２】　前記波形の凹凸面の波の形状が入射端面側の波の高さが小で入射端面から離れるに従って波の高さが大になることを特徴とする請求項１の面光源装置

【請求項３】　前記波形の凹凸面の波の形状が入射端面側が波長が大で入射端面から離れるに従って波長が小になることを特徴とする請求項１の面光源装置

【請求項４】　前記波形の凹凸面の波の形状が入射端面側の波の底と頂点との間の傾き角が入射端面から離れるに従って大又は小になり、最も離れた位置で約４５°～６０°になることを特徴とする請求項１の面光源装置

【請求項５】　前記波形の凹凸面に形成した粗面の粗さが入射端面側が小で入射端面から離れるに従って大になるようにしたことを特徴とする請求項１の面光源装置

【請求項６】前記波形の、波の高さ、波長、波の底と頂点との間の傾き、波の波の表面の粗さのうちから適宜に複数の要件を選んで変化させたことを特徴とする請求項１の面光源装置。

【請求項７】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の前記入射端面と対向する面側に配置した光反射部材と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面を波形の凹凸面としたもので、この波形の凹凸がいずれの方向においても曲面又は曲面と平面とによって連続して形成されて折りおりこの面を粗面としたもので前記波形の面の波の形状が入射端面側の波の高さが小で入射端面から離れるに従って波の高さが大になり前記光反射部材に近付くにつれて再び小になるようにしたことを特徴とする面光源装置。

【請求項８】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の前記入射端面と対向する面側に配置した光反射部材と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面に光源側を波形の凹凸面としたもので、この波形の凹凸がいずれの方向においても曲面又は曲面と平面とによって連続して形成されておりこの面を粗面としたもので前記波形の面の波の形状が入射端面側の波長が大で入射端面から離れるに従って波長が小になり前記光反射部材に近付くにつれて再び大になるようにしたことを特徴とする面光源装置。

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【請求項９】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の前記入射端面と対向する面側に配置した光反射部材と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面を波形の面としたもので、前記波形の凹凸面の波の形状が入射端面側の波の底と頂点との間の傾き角が入射端面から離れるに従って大又は小になることで４５°～６０°に近付き４５°～６０°となった後に前記反射部材に近付くに従って再び大又は小になることで４５°～６０°より離れていくようにしたことを特徴とする面光源装置。

【請求項１０】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の前記入射端面と対向する面側に配置した光反射部材と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面を波形の凹凸面としたもので、前記波形の凹凸面に毛形成した粗面の粗さが入射端面側が小で入射端面から離れるに従って大になり、前記反射部材に近付くに従って再び小になるようにしたことを特徴とする面光源装置。

【請求項１１】　直線状の光源と、前記光源に入射端面を近接させ配置した導光体と、前記導光体の出射面側に配置した拡散板と、前記導光体の前記出射面側と対向する側に設けた反射面とを備えた面光源装置において、前記導光体の前記出射面側と対向する側の面を波形の凹凸面としたもので、前記波形の凹凸面の、波の高さ、波長、波の底と頂点との間の傾き、波の波の表面の粗さのうちから適宜に複数の要件を選んで変化させたことを特徴とする面光源装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、導光体を用いた面光源装置に関するものである。

【０００２】

【従来の技術】従来の導光体を用いた面光源装置は、例えば図１１に示すような構成である。即ち、光源２１にその入射端面２２ａを近接させて導光体２２を配置し、この導光体２２の出射面側には拡散板２３を又導光体２２の前記出射面と対向する側には反射面２４を設けたものである。このような装置によれば、光源２１よりの光は、入射端面２２ａより導光体２２内に入射し、その内部を伝達する間に導光体２２の出射面より出射し、この出射した光は、拡散板２３を通って拡散光となる。これによって面光源を構成することになる。

【０００３】このような面光源装置は、導光体２２に入射した光が、効率良く出射し又拡散板面上で均一輝度分布の拡散光となるように、導光体２２の前記出射面と対向する側の面には拡散性の塗料による印刷等の手段で一定のパターン形状の微小拡散部を形成するのが一般的である。

【０００４】このような面光源装置は、例えば、液晶表示装置のバックライト等に利用されるため、明るい面光源が要求される。しかし前記のような構成の従来の面光源装置は、十分な明るさを得ることが出来ない。

【０００５】そのために、この種の面光源装置において、明るさを増大させるために色々な工夫がなされている。

【０００６】例えば、特開平３－１８９６７９号公報や、実開平３－３１７８２号公報に記載の面光源装置がある。この面光源装置は、導光体の前記出射面側と対向する側の面に角錐状の凸部または凹部を多数形成することによって輝度の増大をはかり又この角錐状の凸部または凹部の面積を場所により変化させるようにして輝度の均一化をはかっている。

【０００７】しかしこのような方法では、角錐の面の面積が比較的広いため明るさを増大させることは出来るが、面積を変化させても輝度分布を十分均一にすることは困難であった。又凸部または凹部が角錐状であるために角の部分（鋭い角になった部分等）が特に光る等の欠点がある。

【０００８】以上のような欠点を解消するために本出願の出願人が先に出願した平成４年実用新案登録願第２４６０１号及び平成４年実用新案登録願第２４６０８号の面光源装置がある。それは夫々図１２乃至図１５および図１６乃至図１９に示す構成である。

【０００９】まず図１２乃至図１５に示す面光源装置は、導光体２２の出射側の面と反対側の面２２ａに球面状の凹部２５や球面状凸部２６を設けたものや、円筒状の凹部２５’や円筒状の凸部を有するもので、これによって明るさを増加させることが出来又、これら凹部又は凸部を粗面とすることによって輝度を均一にすることが出来る。

【００１０】又図１６に示す面光源装置は、同様に導光体２２の下面２２ａに凹部又は凸部を設けたもので、これによって明るさを増加させると共にこれら凹部又は凸部に粗面を形成しこの粗面の粗さで変化させ出射面全体にわたってより均一な輝度分布が得られるようにしている。又図１７乃至図１９に示すように凹部、凸部のピッチを変化させ、あるいは凹部の深さ又は凸部の高さを変化させて出射面全体にわたってより均一な輝度分布が得られるようにしたものである。

【００１１】

【発明が解決しようとする課題】このような図１２乃至図１９に示す導光体は、、凹部、凸部がいずれも断面が角状部分を含んでおり、このような角状部分は、他の部分に比べて明るくなり部分的に輝いて見える。又導光体の凸部又は凹部を有する面は平面に多数の凸部又は凹部が形成された形状であるため、導光体を薄くした時には拡散板側よりこの凸部又は凹部が明瞭に見えそのために拡散板を通してもこれが見え好ましくない。

【００１２】

【課題を解決するための手段】本発明の面光源装置は、光源と、この光源にその入射端面を近接させて配置した導光体と、導光体の表面側（出射面側）に配置した拡散板と、導光体の裏面側（拡散板側と反対側）に配置した反射面とで構成したもので、導光体の裏面（出射面とは反対側の面）を波形の多数の凹凸面としたもので、この波形の凹凸がいずれの方向においても曲面又は曲面と平面とによって連続して形成されていて点又は線状をなす部分の存在しない形状としたことを特徴とし、更にこの波形の裏面を所謂しぼを形成する等の粗面として、波形とあわせて輝度の均一化をはかっている。

【００１３】このように本発明の面光源装置は、導光体の裏面が連続した波形をなすためこの波形の面での光の反射や屈折作用によって明るい面光源を得ることが可能であると共に、この面上の各部分での方向（接平面の傾き）の変化が連続しているために、拡散光の輝度分布が拡散板面全体で均一である上に部分的にも急激な輝度変化がなく局部的に輝くこともない良好な輝度分布になし得る。又導光体が透明であり更に裏面が連続面であるので平面でなくとも波形が表面側から見えることはない。

【００１４】更に裏面の波形の面を粗面にする場合、裏面が連続面であるため面全体として所望の粗面にすることが加工上容易である。

【００１５】

【実施例】次に本発明の面光源装置の実施例を図面にもとづき説明する。

【００１６】図１は本発明の面光源装置の断面図で、１は光源、２は導光体、３は拡散板、４は反射面である。この実施例の面光源装置は、導光体２の裏面２ｂが図示するような波形をなしている。しかもこの波形の面は、図面では縦断面で入射端面に垂直な断面を示すが、表面２ｃに垂直な断面形状がその垂直面の異なる断面例えば入射端面２ａに平行な断面や入射端面２ａと傾いた断面においてもすべてが連続した波形であって、したがって導光体の裏面２ｂは、全ての部分において曲面又は平面と曲面とを組み合わせた面で連続した面であって、例えば錐形状の頂角のような部分や稜線のような部分などが存在しない形状である。更にこの波形の曲面は粗面になっている。

【００１７】この実施例においては、光源１よりの光は、導光体２の入射端面２ａより入射した後、表面２ｃおよび裏面２ｂにて夫々全反射し（その一部は表面より射出し又裏面より出た光は反射面にて反射される）入射

端面２ａとは反射側へ伝達されて行く。ここで一部の光が表面２ｃより出射して拡散板３を通って拡散光となり面光源となる。

【００１８】この実施例では、裏面が波形面であるためここで全反射される光は、反射箇所により異なった方向に反射され、又裏面を通り反射面４で反射されて再度入射する光は、波形の面で夫々屈折され場所により異なった方向へ進む。この裏面２ｂの波形面の作用によって導光体の表面２ｃより射出する光は均一化されしかも明るい光となる。更に波形の面を粗面としたことにより拡散作用が加えられ均一な輝度となる。

【００１９】ここで裏面が波形でありしかもすべての方向で連続しているので、この面による光の反射方向又は屈折されて表面へ向かう方向の場所により変化も連続的であるために部分的に輝度が大になることがなく、拡散板上で輝く部分の生ずることが全くない。又裏面を粗面にする場合、裏面の全ての部分が連続しているためすべての部分を均一な粗面とすることや場所により粗さを変化させる場合も比較的容易になし得る。

【００２０】図１では波形を同じ形状に記載してあるが、波形の形状や大きさによって各部分で光が反射又は屈折する方向が異なってくる。したがって本発明の照明装置においては、より均一な輝度分布で明るいものを得るために、実際には波の形状や大きさを場所により変化させている。又面光源装置の用途によっても波形の大きさや形状の分布を異なるものにしている。

【００２１】図２は波形の面の断面形状の一例を示す図である。実験結果からこの図において、波の高さｈが大である程、その波の上部の出射面における明るさが大になる。又波の波長に相当するｆが小である程、その波形の上部の出射面における明るさが大になる。又波の形状としては、ｇの部分の傾き角を４５°～６０°とした時が最も明るくそれよりも大または小になるにつれ暗くなる。

【００２２】一般に導光体を用いた面光源装置は、導光体の光源に近い側（入射端面に近い側）の出射光が比較的大であって、これより離れるにつれて次第に小になる。そのため導光体の裏面の波形としては、図３に示すように入射端面２ａに近い側の高さｈを小にしこれより離れるにつれて次第に大にすることが望ましい。これによって拡散板３上での輝度を均一にすることが可能になる。

【００２３】図４は、他の具体例であって、導光体２の裏面の波形をその波長ｆが入射端面２ａに近い側が大であって、これより離れるにつれて小になる形状にしてその表面での明るさを均一にて輝度分布が全体として均一になるようにしたものである。尚この場合高さｈはほぼ一定である。

【００２４】図５は、図面左右両側に光源１を配置したもので、全体の明るさを大にしたものである。この具体例の場合、光を両側より入射させるため左右の入射端２ａ、２ａ’に近い方の波の高さｈを小にし中心へ向けて次第にｈが大になるようにしている。これによって出射面での明るさを均一にすることが可能になる。

【００２５】図６は、更に他の例であって、波形の形状を連続的に変化させて均一な明るさの面光源を得るようにしたものである。つまり図２におけるｇの部分の傾き（図１０の角θ）が順次異なるようにしたもので入射端面側が傾き角が小でこれから離れるにつれて次第に大になり入射端面と反対側の端面付近において傾き角が４５°～６０°の範囲内にしてある。

【００２６】また、図６とは逆に、図２におけるｇの部分の傾きが入射端面側が大でこれから離れるにつれて次第に小になり、入射端面と反対側の端面付近において傾き角が４５°～６０°の範囲になるようにしてもよい。

【００２７】図７は、導光体２の入射端面２ａと反対側の端面２ｄ側に反射テープ等の光反射部材５を配置したものである。この面２ｄが透明な面の場合、この面より光が出てしまうためこの面側に反射テープ等の光反射部材５を配置して逆方向に戻して明るさを大にしたものがある。このように２ｄ側に反射テープ等の光反射部材５を配置し、しかも表面も裏面も平面である平板状の導光体を考えた場合、出射面側での明るさは入射端面において最も明るく次第に減少し入射端面と反対側の面２ｄに近づくにつれて再び増大する傾向となる。したがって図７のように導光体２の裏面２ｂの波形をその高さｈが入射端面２ａ側で最も小で次第に大にして行った後に面２ｄに近づくにつれ再び小にすることが好ましい。

【００２８】図８，図９は導光体１２，１２’の基本形状自体が入射端面において厚さが大で次第に薄くしたもので、これら導光体の裏面１２ｂ，１２ｂ’を前述の波形にしたものである。

【００２９】以上述べた図３乃至図９に示す実施例は、いずれも導光体を用いた一般の面光源装置が、導光体より出射する光の量が入射端面に近い方が大でこれより離れるにつれて小になる点を解消することを目的としてなされたものである。したがって波の高さｈ、波長ｆや波の形状であるｇの部分の傾き角等の変化がいずれも入射端面に垂直な方向に生ずるものである。そのため導光体の裏面全体でみた場合波形によるうねりは入射端面に垂直な方向においてはすべてほぼ同一形状になっている。そしてこのようなうねりをもつ凹凸がすべての方向つまり入射端面に平行な方向や入射端面に対し傾いた方向においては、前記の垂直な方向とは必ずしも一致するものではないがそれらがすべてにおいて曲面又は平面と曲面とによって連続的に接続させた形状であって、点状や線状となる部分が全くない。

【００３０】以上の説明は、導光体の一方の端面にのみ光源を配置したいわゆる１灯式又は２灯式のものについて述べたが、導光体の４辺の全てに光源を配置した、所

謂、４灯式の面光源装置や、導光体の３辺に光源を配置した３灯式の面光源装置に適用しても勿論よい。これらの場合、光源からの光の届きにくい部分ほど、前記のｈの値の大きな又はｆの値の小さな波形とし、また粗面の粗さも、光の届きにくい部分ほど大きくすればよい。更に前記のｇの傾きを変化させてもよい。また、前記のｈとｆの値、粗さ、前記のｇの傾きのうちから適宜にいくつかの項を選んで組み合わせて、変化させてもよい。

【００３１】尚凹部の内面や凸部の外面を粗面にした導光体を形成するには、次の方法を用いればよい。つまり、先ず波形を有する金型を作りこれにサンドブラストやエッチング、又は放電加工による方法にて金型を作り、この金型を用いて射出成形等の成形手段により形成出来る。この場合、放電加工の方法によれば、作業が簡単であり、所望の粗面が正確に得られる等により好ましい。

【００３２】

【発明の効果】本発明は、導光体の反射面をいずれの方向においても曲面又は、曲面と平面とが連続していて点又は、線状をなす部分の存在しない波形とし、更に前記反射面を粗面とし、前記波形の高さ、波長波形の傾き、面粗面度を適宜に変化させることで、極めて均一な輝度分布を示す面光源装置を提供することができる。

【図面の簡単な説明】

【図１】　本発明の面光源装置の実施例の断面図

【図２】　本発明の導光体に形成する波形の一例を示す図

【図３】　本発明の実施例の導光体で波形の高さを場所により変化させた例を示す図

【図４】　本発明の実施例の導光体でその長さを場所により変化させた例を示す図

【図５】　本発明で導光体の両端に夫々光源を配置した実施例を示す図

【図６】　本発明の実施例の導光体で波の傾き角θを場所により変化させた例を示す図

【図７】　本発明の実施例の導光体で入射端と反射側端面を反射面にした例を示す図

【図８】　本発明の実施例の導光体で裏面を傾斜させた例を示す図

【図９】　本発明の実施例の導光体で中央の厚さが小になるように裏面を傾斜させた例を示す図

【図１０】　本発明の実施例の導光体に形成する波の傾きθを示した拡大図

【図１１】　従来の面光源装置の断面図

【図１２】　半球状凹部を形成した従来の導光体を示す図

【図１３】　円筒状凹部を形成した従来の導光体を示す図

【図１４】　図１３の凹部に更に曲面を形成した従来の導光体を示す図

【図１５】　半球状凸部を形成した従来の導光体を示す図

【図１６】　凹部を形成し内面を粗面にした従来の導光体を示す図

【図１７】　場所により変化する凹部を形成しその内面を粗面にした従来の導光体を示す図

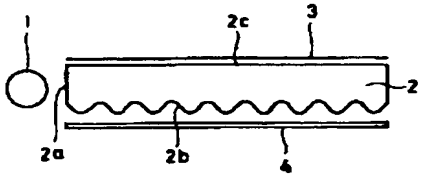
【図１８】　図１７の凹部を変形した従来の導光体を示す図

【図１９】　場所により変化する凸部を形成しその表面を粗面にした従来の導光体を示す図

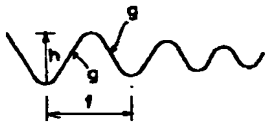
【符号の説明】

１　光源
２　導光体
２ｂ　波形の凹凸面
３　拡散板
４　反射面

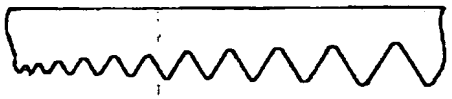
【図１】



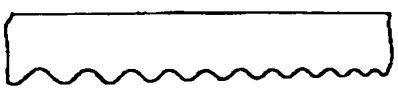
【図２】



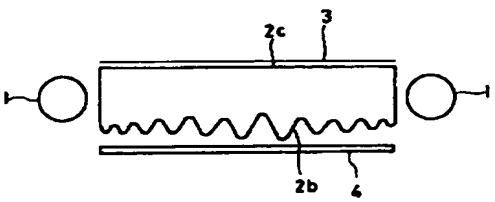
【図３】



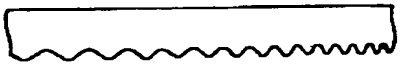
【図４】



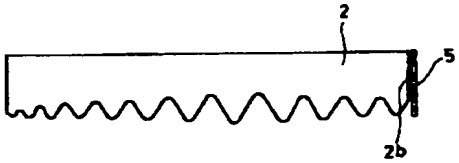
【図５】



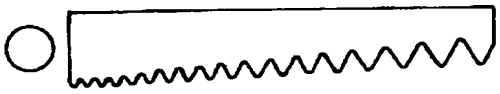
【図６】



【図７】



【図８】



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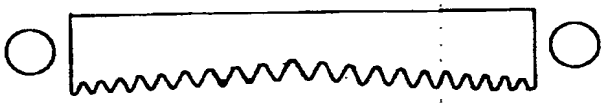
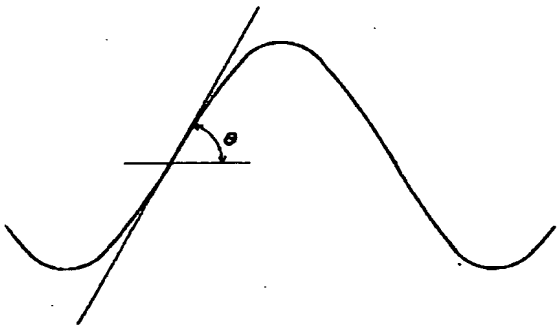
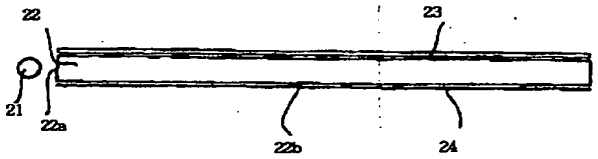


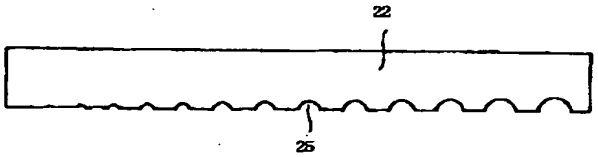
【図１０】



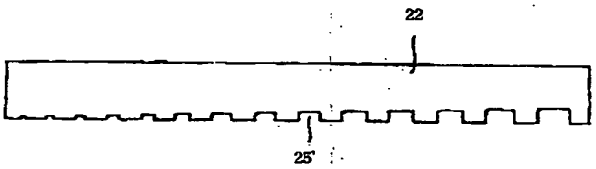
【図１１】



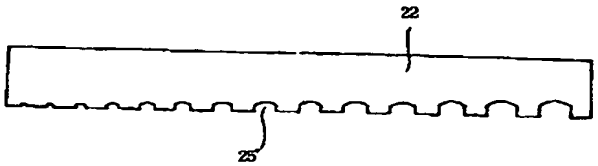
【図１２】



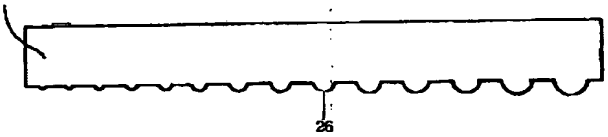
【図１３】



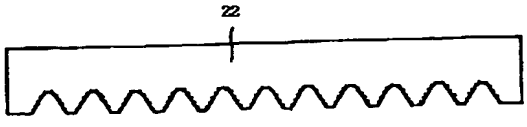
【図１４】



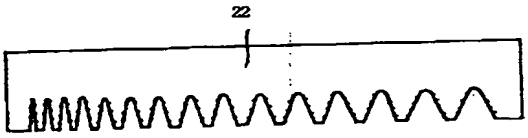
【図１５】



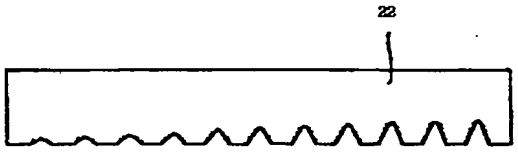
【図１６】



【図１７】



【図１８】



【図１９】